10/518823

1 / 19

Structure of Preferred embodiments of the invention

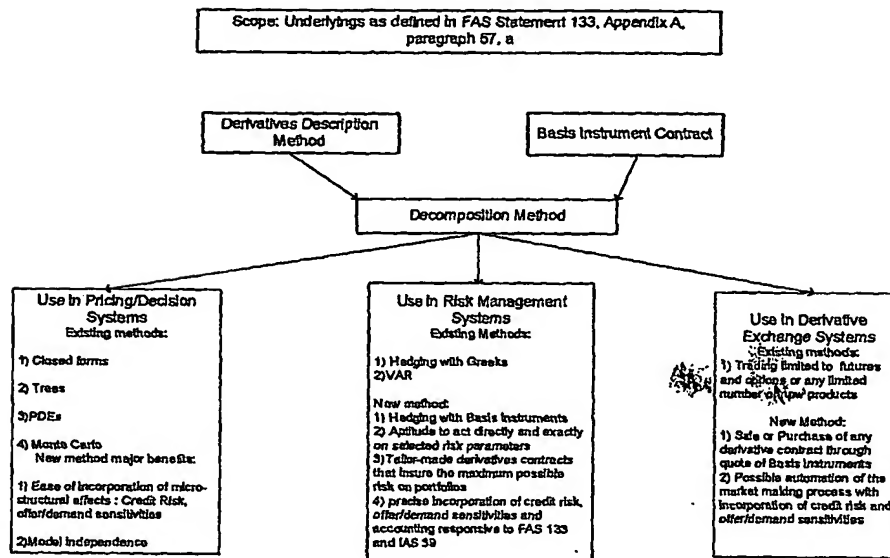Scope: Underlyings as defined in FAS Statement 133, Appendix A, paragraph 57, a

Derivatives Description Method

Basis Instrument Contract

Decomposition Method

Use in Pricing/Decision Systems
Existing methods:

1) Closed forms

2) Trees

3)PDEs

4) Monte Carlo
New method major benefits:

1) Ease of incorporation of micro-structural effects : Credit Risk, offer/demand sensitivities

2)Model independence

Use in Risk Management Systems
Existing Methods:

1) Hedging with Greeks
2)VAR

New method:
1) Hedging with Basis instruments
2) Aptitude to act directly and exactly on selected risk parameters
3) Tailor-made derivatives contracts that insure the maximum possible risk on portfolios
4) precise incorporation of credit risk, offer/demand sensitivities and accounting responsive to FAS 133 and IAS 39

Use in Derivative Exchange Systems
Existing methods:
1) Trading limited to futures and options, or any limited number of new products

New Method:
1) Sale or Purchase of any derivative contract through quote of Basis Instruments
2) Possible automation of the market making process with incorporation of credit risk and offer/demand sensitivities

Figure 1: Structure of preferred embodiments for the invention

Basis Instrument Contract
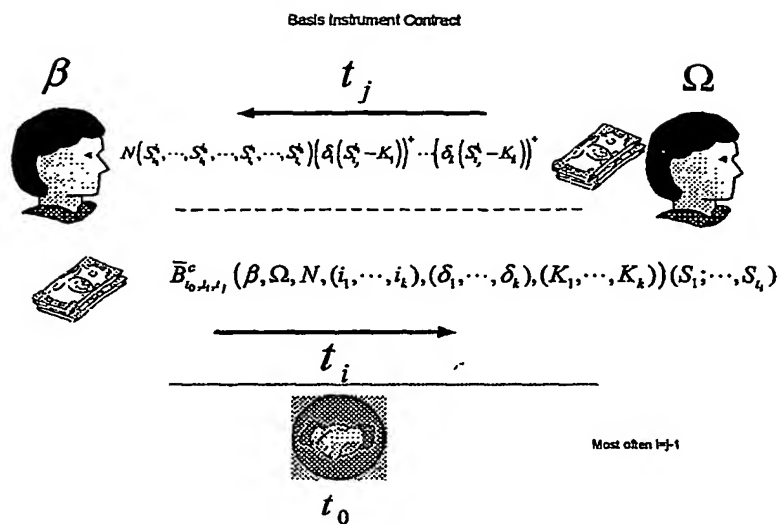
Figure 2: Definition of Basis Instruments Contracts

19

Product Description

$$f(S_0; \beta_0; \Omega_0; \cdots; S_n; \beta_n; \Omega_n) \, (resp. \, f(S_0; \Omega_0; \beta_0; \cdots; S_{n-1}; \Omega_n; \beta_n))$$

$$\beta_i \in \mathfrak{R}_A^{n=+1}; \, \Omega_i \in \mathfrak{R}_\Omega^{n=+1};$$

28

$$f(S_0; \beta_0; \Omega_0; \cdots; S_n; \beta_n; \Omega_n) \, (resp. \, f(S_0; \Omega_0; \beta_0; \cdots; S_{n-1}; \Omega_n; \beta_n))$$
$$\beta_i \in \mathfrak{R}_A^{n=+1}; \, \Omega_i \in \mathfrak{R}_\Omega^{n=+1};$$

19

281

Description Reduction Algorithm

282

$$\bar{f}(S_0; \cdots; S_n)$$

Description Reduction
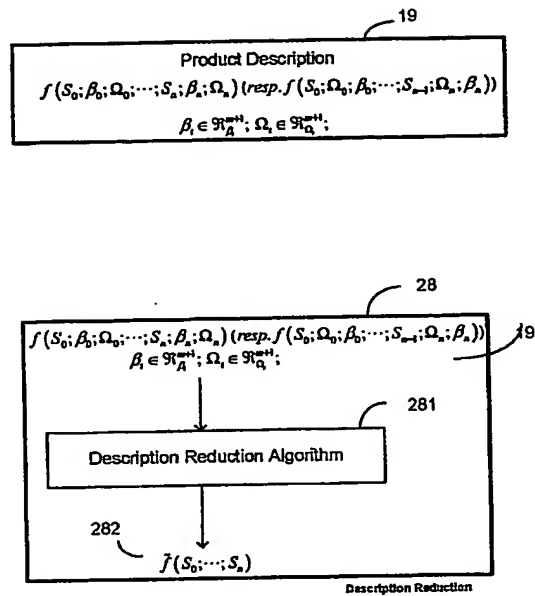
Figure 3: Derivatives Reduction

4 / 19

Iterative derivatives decomposition process
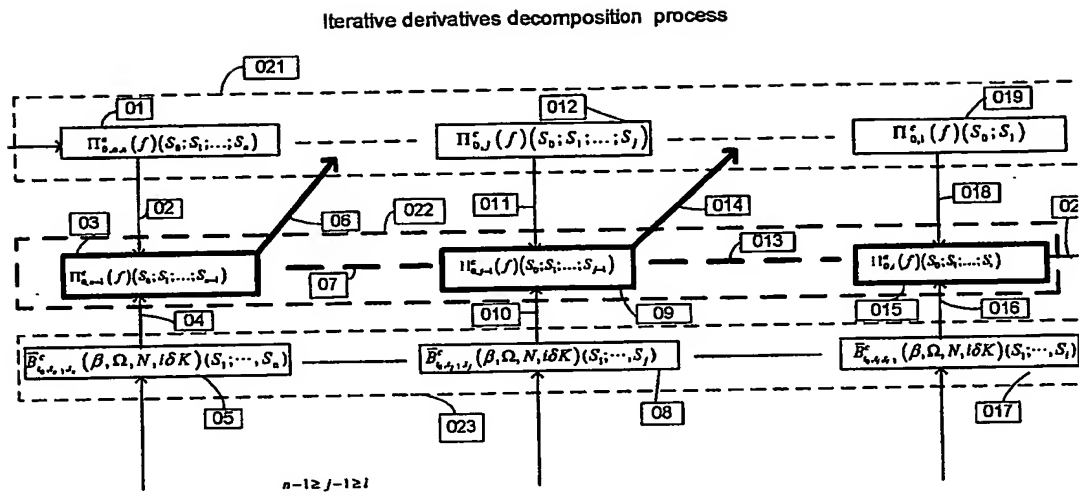
Figure 4: Iterative Derivatives Decomposition Process
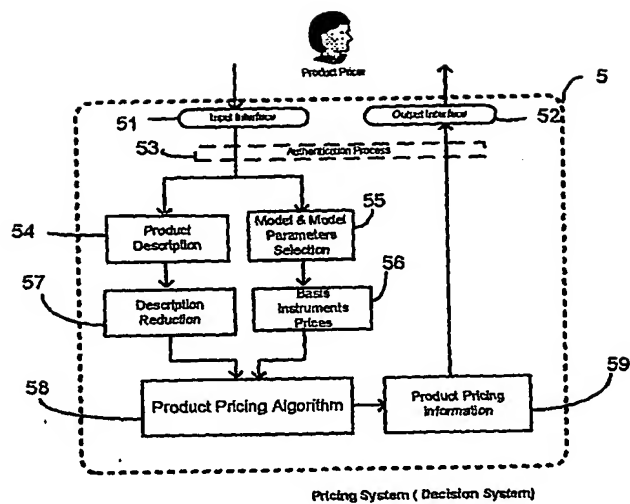
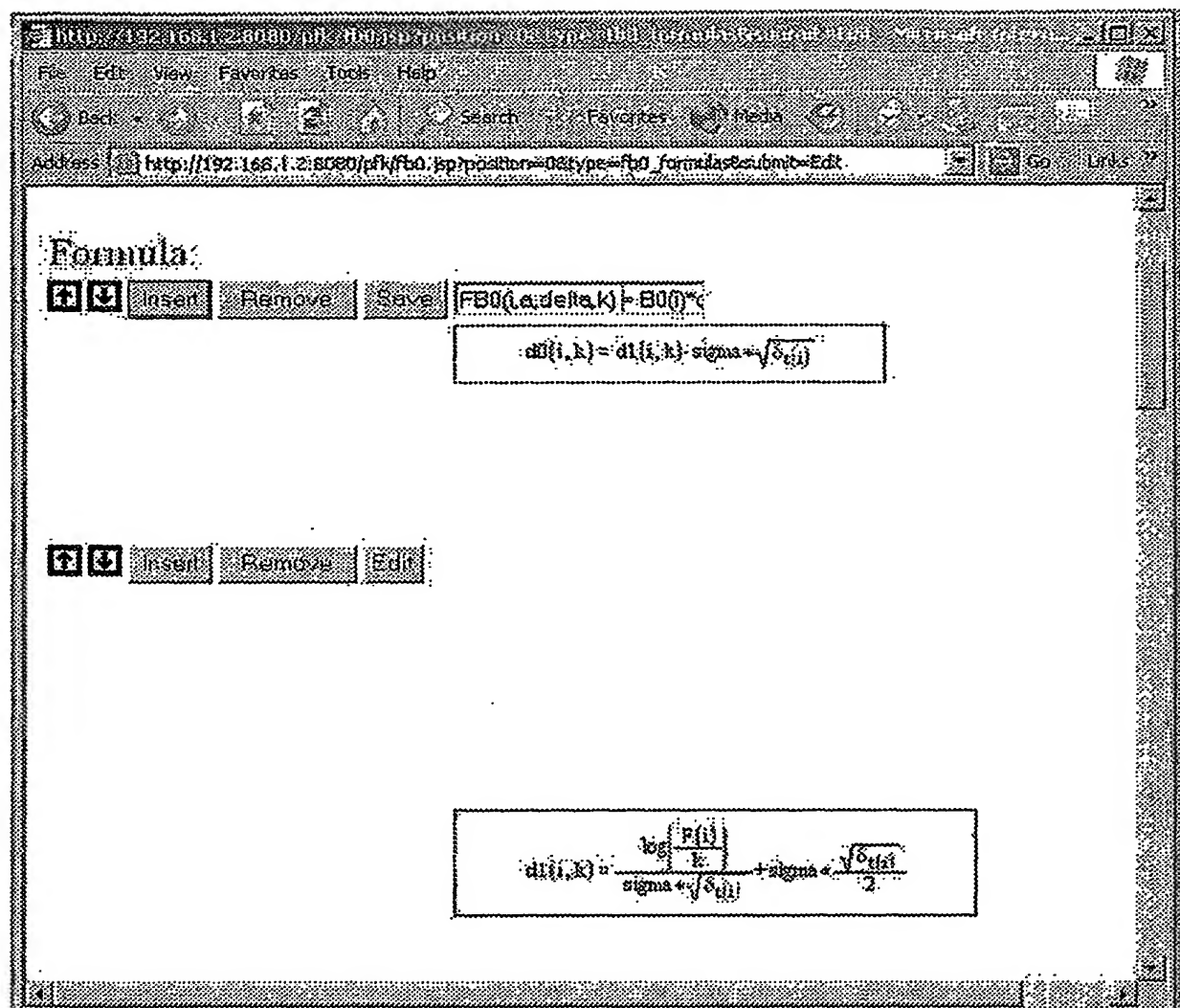Figure 5: Pricing system
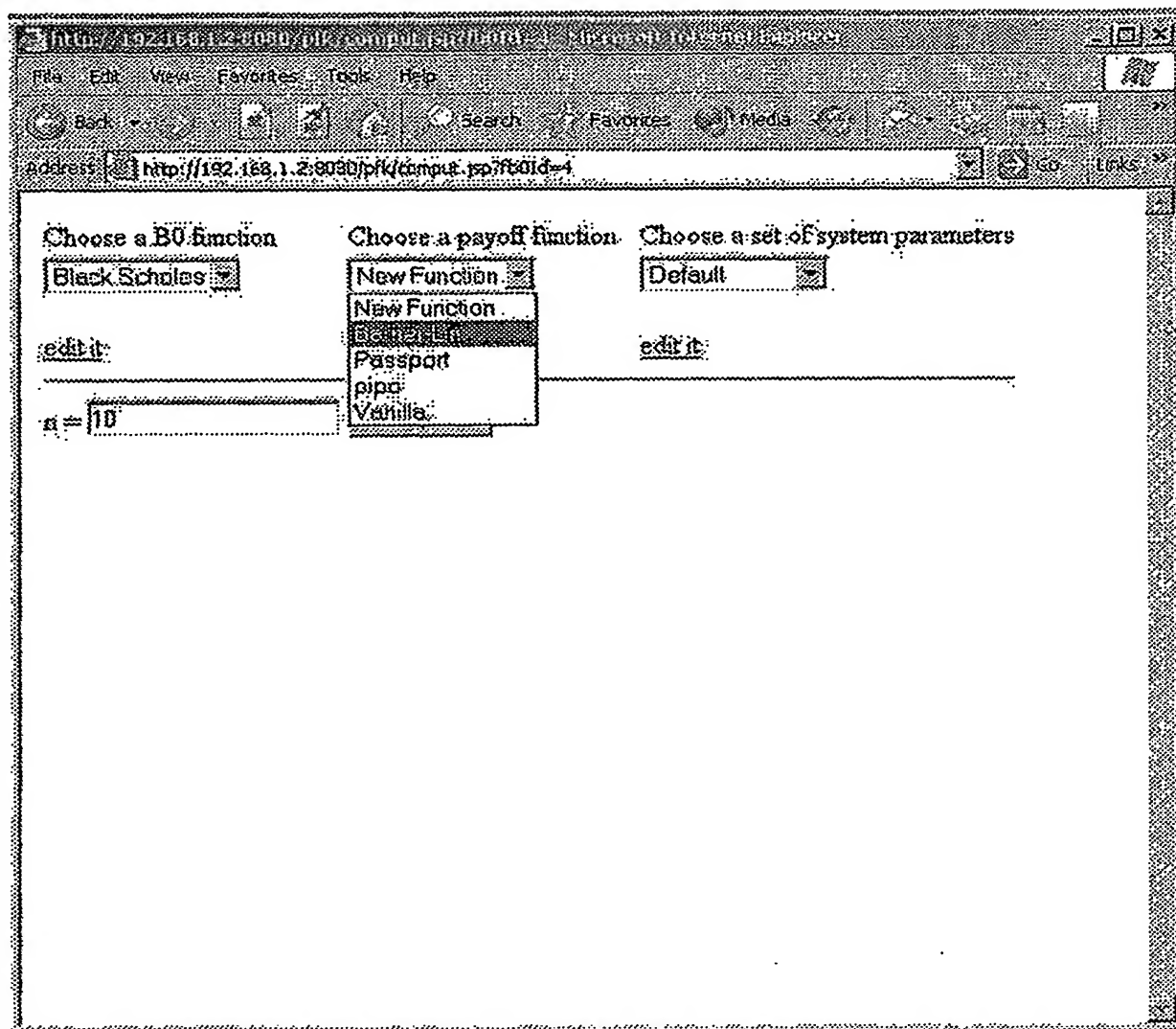
Figure 6: Web Interface : Main screen

10/518823

Figure 7: Web Interface : Basis Instrument Input

Figure 8: Web Interface : Payoff Function Input

10/518 823
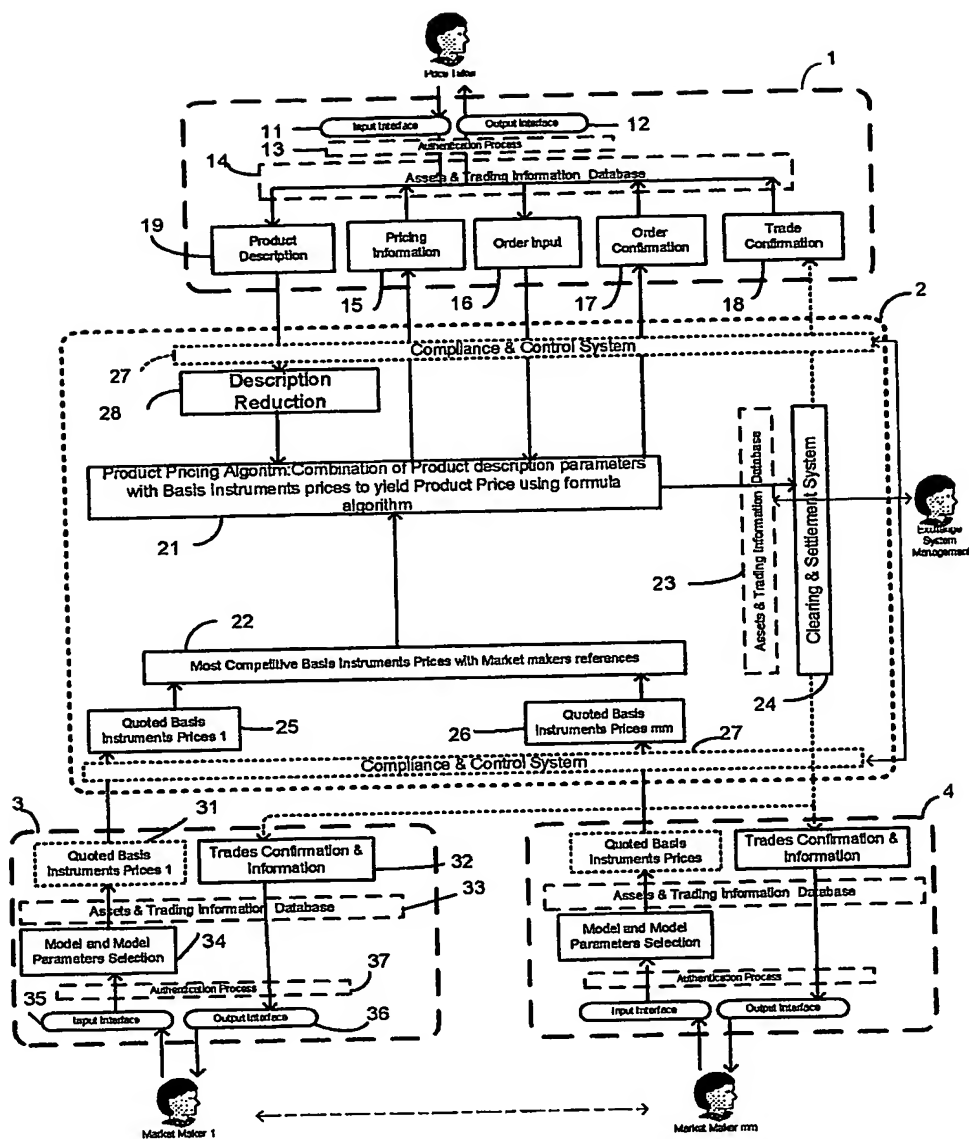
Figure 9: Exchange trading system

┌──┐ ⌐ 16
│   **Order Input**   │
│   (1) Product Description Reference   │
│   **or**   │
│   (2) Product Description and Quoted Price │
│   Reference   │
└──┘

┌──┐ ⌐ 17
│   **Order Confirmation**   │
│   │
│   (1) Acknowledgement of order input/cancellation │
│   with pricing and timing references │
└──┘
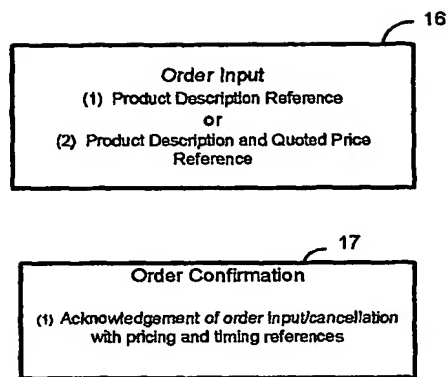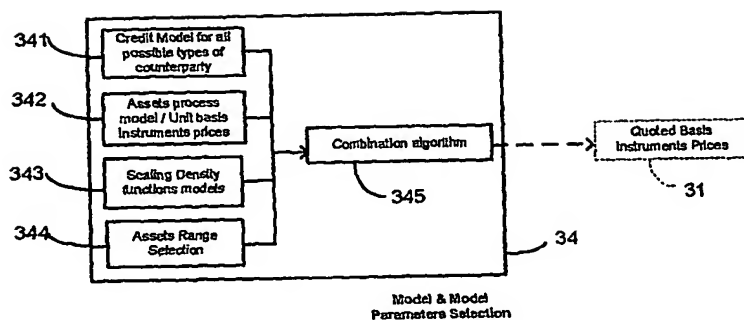
Figure 10: Exchange Order Input & Confirmation

Figure 11: Model & Parameter selection

Basis instruments price selection process in an exchange framework
*Illustration of Basis instruments syndication to market makers to most efficiently reduce
derivatives prices quoted to price takers*

$$\bar{B}^c_{i_0,j_{i-1},i_j}(\beta,\Omega,N,i\delta K)(S_1;\cdots,S_j) = \int_0^N \underset{1\le k\le mm}{Min}\ \bar{B}^c_{i_0,j_{i-1},i_j}(\beta,\Omega_k,i\delta K)(S_1;\cdots,S_j)dn$$ 44

$\bar{B}^c_{i_0,j_{i-1},i_j}(\beta,\Omega_1,i\delta K)(S_1;\cdots,S_j)$ — — — — $\bar{B}^c_{i_0,j_{i-1},i_j}(\beta,\Omega_k,i\delta K)(S_1;\cdots,S_j)$ — — — — $\bar{B}^c_{i_0,j_{i-1},i_j}(\beta,\Omega_{mm},i\delta K)(S_1;\cdots,S_j)$

41   42   43

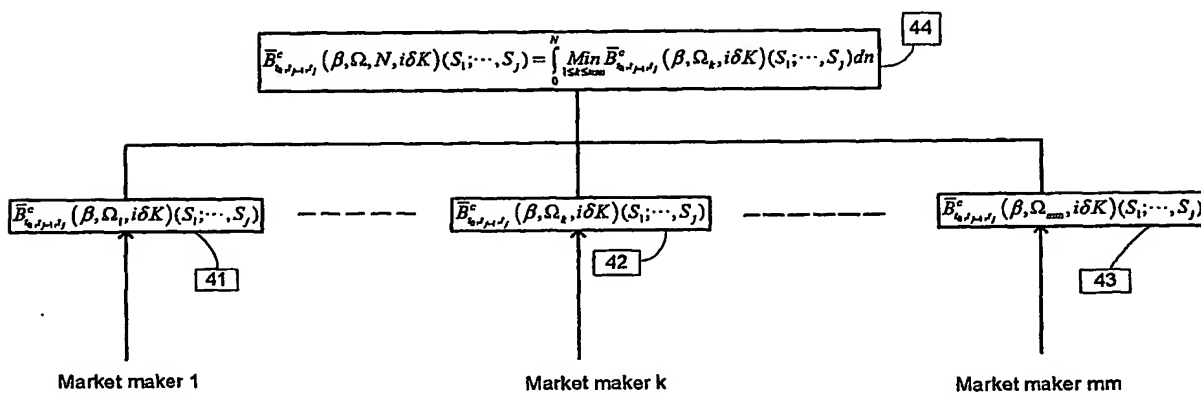Market maker 1   Market maker k   Market maker mm

Figure 12: Basis instruments price selection process

Derivatives Pricing Approximation Process by selecting block units and
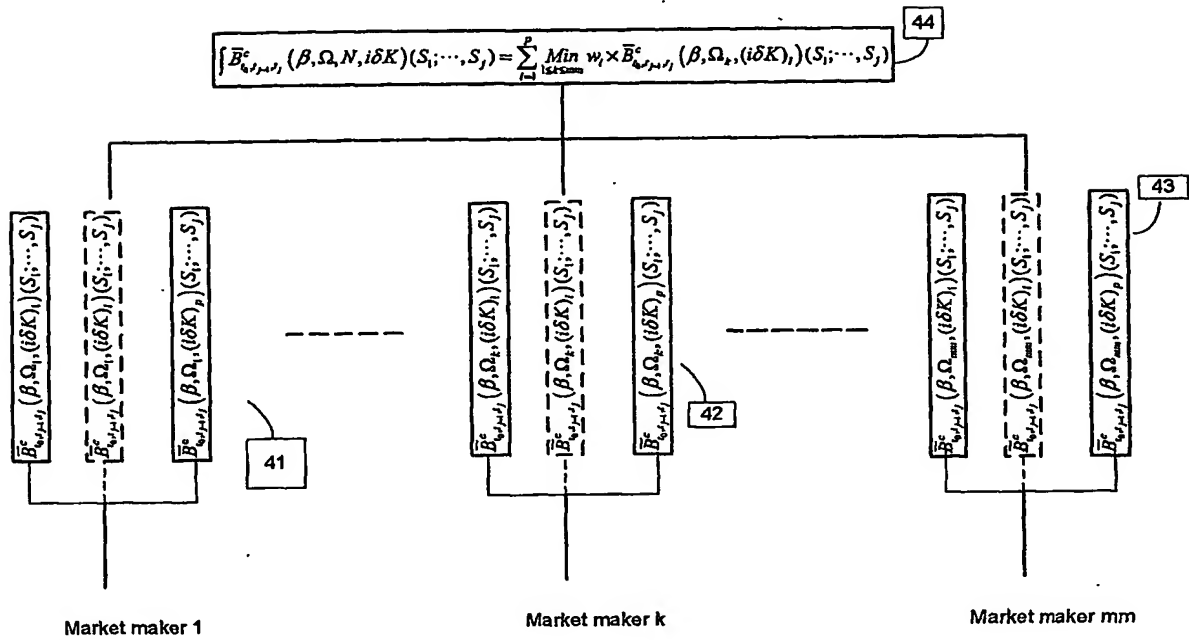recombining while keeping a cap on approximation error

Figure 13: Derivatives Pricing Approximation Process by selecting block units
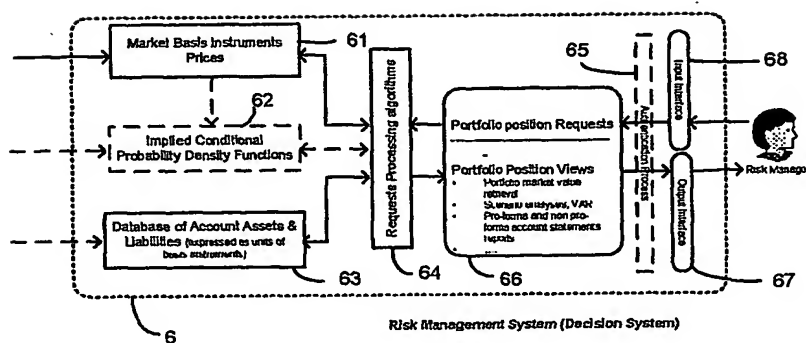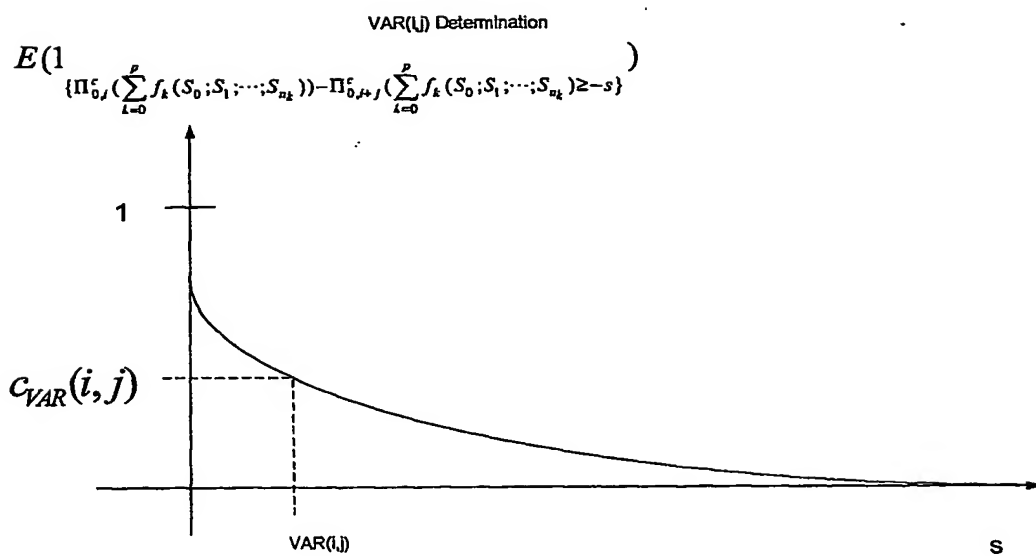
Figure 14: Risk Management system

10/518823

VAR(i,j) Determination

$$E(1_{\{\Pi^c_{0,j}(\sum_{k=0}^{p} f_k(S_0;S_1;\cdots;S_{n_k}))-\Pi^c_{0,j+j}(\sum_{k=0}^{p} f_k(S_0;S_1;\cdots;S_{n_k})\geq -s\}})$$

1

$c_{VAR}(i,j)$

VAR(i,j)

s

Figure 15: Risk Management, VAR Method

VAR Risk Management Method
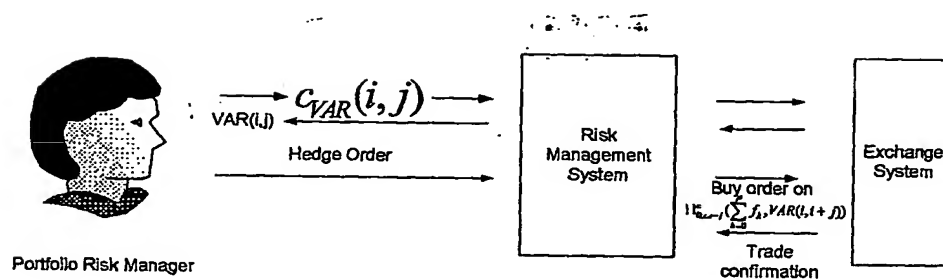
Figure 16: Risk Management, VAR Method

The Dangers of Value at Risk (VAR) logic

Market Implied Density

Portfolio weighted Implied density

yt0
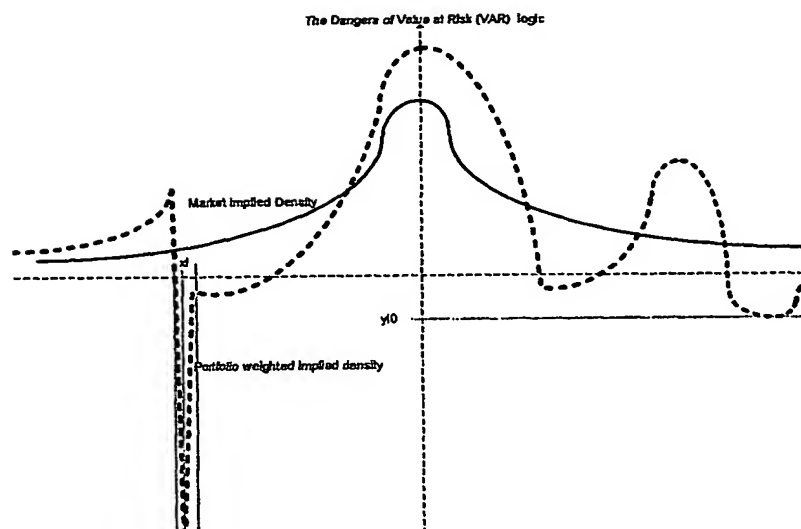
Figure 17: Risk Management, VAR danger.

10/518823

PCT/US03/19179

$$\Pi^c_{\alpha,H,J,H}(f)(S_0;\cdots;S_H)$$

Is it a form known for its analytical tractability ?

Are there known sets of transformation rules likely to allow the
function to be reduced to a function of at most two (for example) asset values variables ?

Match ?

YES   NO

Approximation decomposition with
error within bid/offer spread range
Criteria Check; Match ?

Taylor Decomposition
Fourier Decomposition
Wavelets
Other ?

Reduced form representation of
$$\Pi^c_{\alpha,H,J,H}(f)(S_0;\cdots;S_H)$$
as
$$\Pi^c_{\alpha,\beta}(f)(X_{H};X_{J})$$

Other Reduced form representation
of
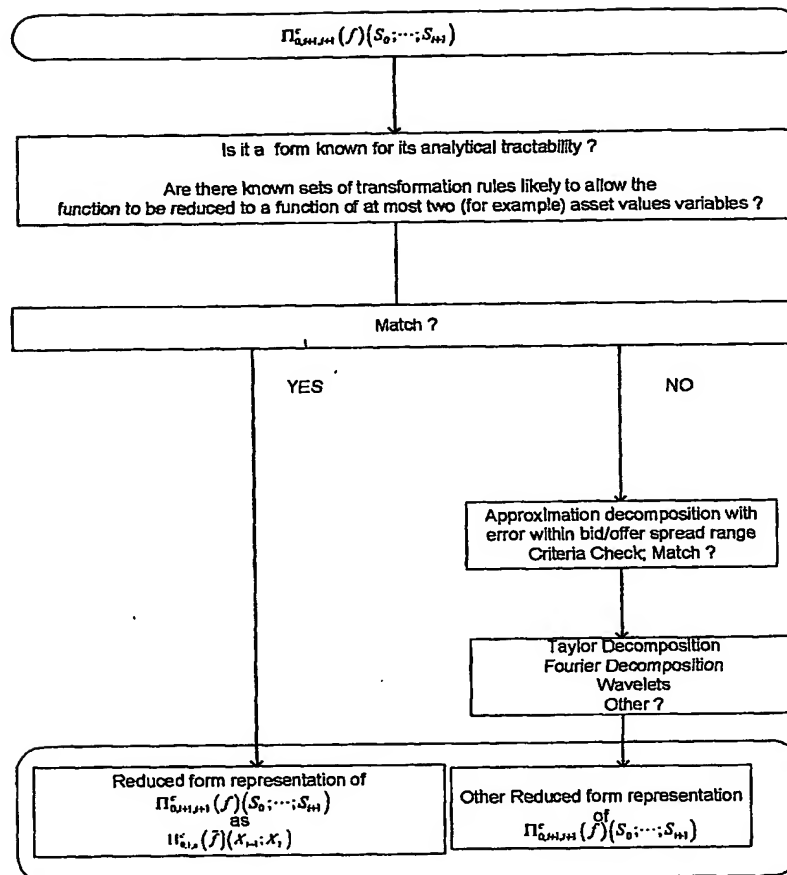$$\Pi^c_{\alpha,H,J,H}(f)(S_0;\cdots;S_H)$$
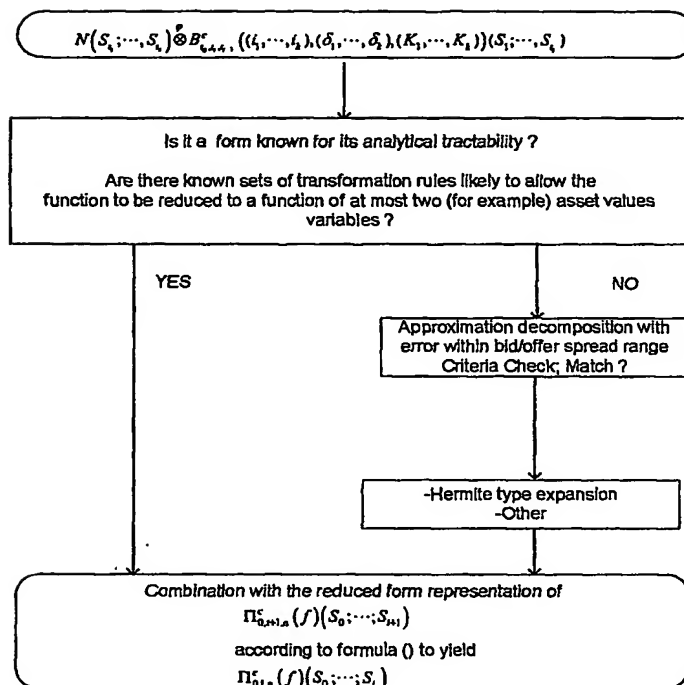
Figure 18: Compression to reduced form of Derivatives

Figure 19: Compression to reduced form of Basis Instruments